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SMART DESIGN FOR LIVABLE COMMUNITIES

ENGINEERS | LANDSCAPE ARCHITECTS | PLANNERS

Flood Proofing Buildings

Flooding on Flat Street in Brattleboro, 2011
(Photo: Kevin O'Connor)

- FEMA
  - Guidelines for Federal Insurance
  - Local zoning overlay district
  - Plan review by ANR
- Fluvial Erosion Hazard District
  - ANR stream map
  - Model local zoning ordinance
  - No flood proofing

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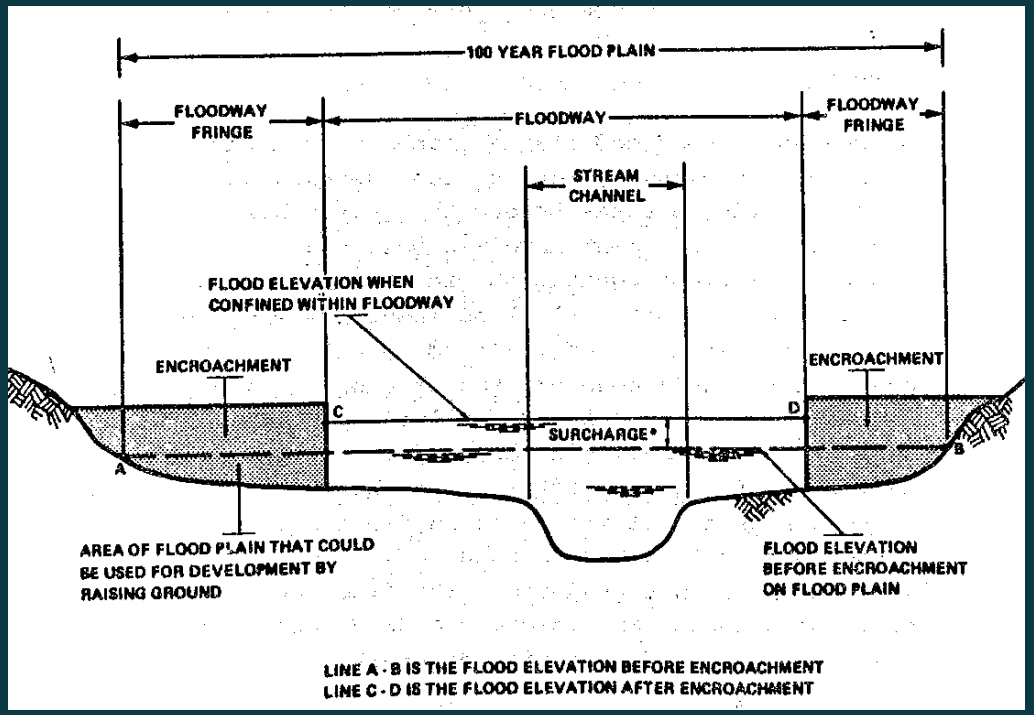
FEMA Inundation Regulations



- Flood Boundaries
  - Floodway
  - 100 yr Floodway Fringe
  - 500 yr Flood Plain
- Zoning Overlay District
  - Base Flood Elevation (100 yr)
- Federal Projects
  - Executive Order 11988 (500yr)

Flood Proof Design

Dutton Farm Stand

Marina Restaurant

- Elevate First Fl to 1 Ft above BFE
  - Residential only option
- Wet Flood Proofing Basement
  - Allow inundation
  - Flood Vents
  - Flood resistant materials
  - Mechanical & Electrical
  - Flotation

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Flood Proof Design

New England Youth Theater

- Dry Flood Proofing
- Protect the structure to 1 ft above BFE and keep water out.

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Flood Proof Design

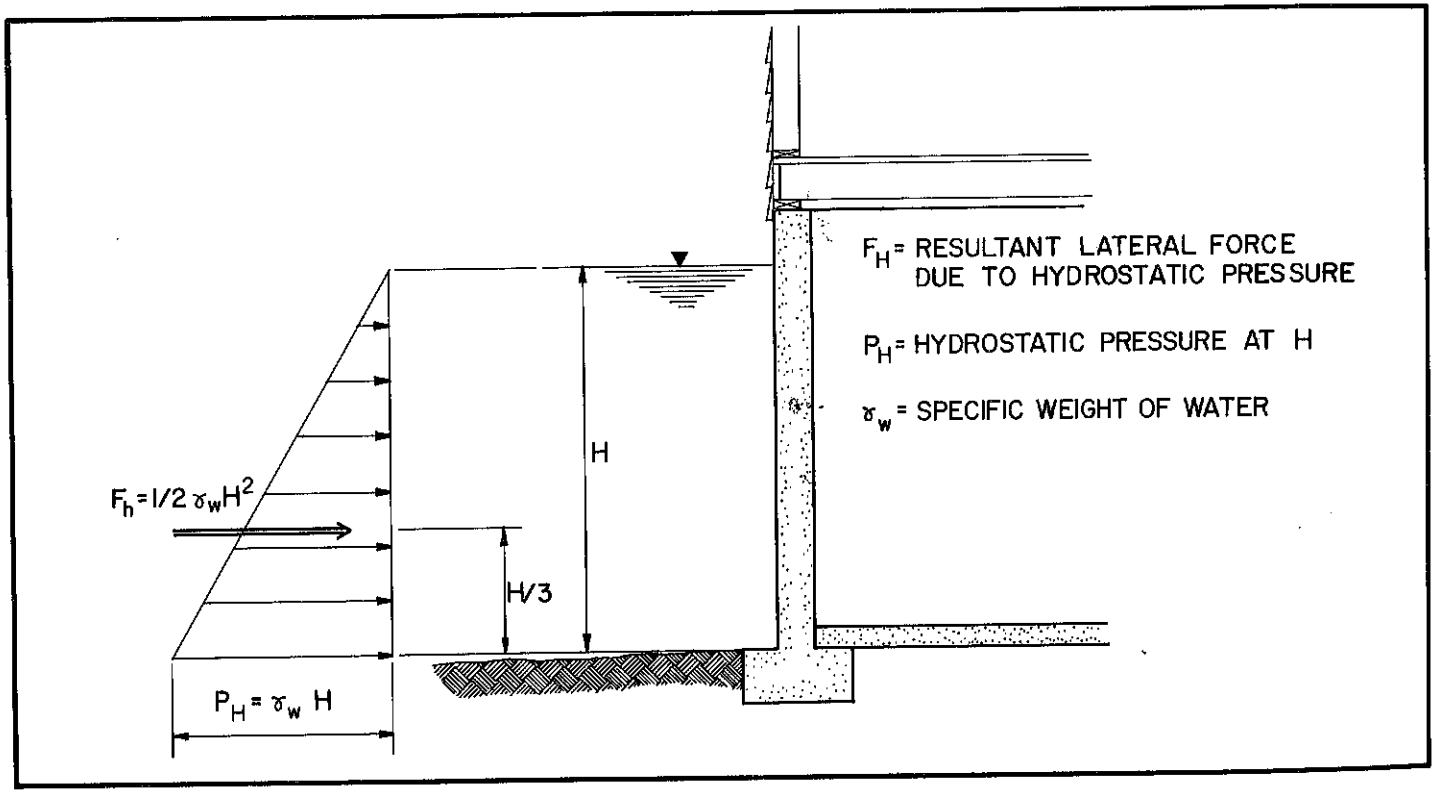

FIGURE C-1. Hydrostatic Force Diagram

- Dry Flood Proofing
- Hydrostatic Forces

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Flood Proof Design

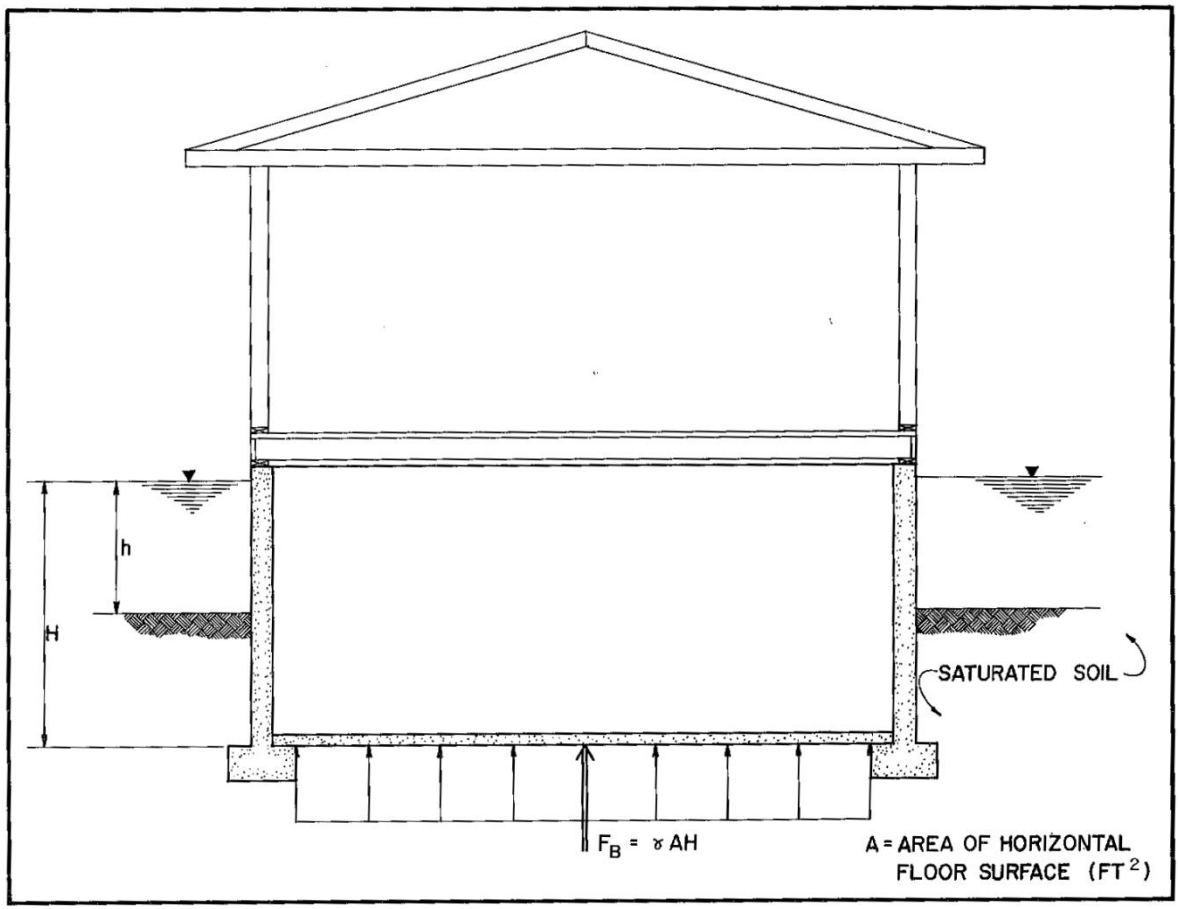

FIGURE C-2. Buoyancy Force Diagram

- Dry Flood Proofing
- Hydrostatic Forces
- Buoyancy Force
  - Flood Duration
  - Seepage rate
  - Slab Dead load
  - Boat Design

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Flood Proof Design

- Dry Flood Proofing
  - Hydrostatic Forces
  - Buoyancy Force
  - Hydrodynamic Force
    - 10 fps = 1.5 ft
  - Impact Loads
    - Normal = 1000 lbs
    - Special = 100 lbs/ft
    - Extreme = KYAG
  - Wind
  - Soil Loads

Grafton Town Garage

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Flood Proof Design

Cultural Intrigue

- Dry Flood Proofing
  - Perimeter wall
  - Flood gates
  - Water Tight Concrete
  - Flood Wall
  - Elevate Toilets
  - Floor Drain check valve
  - Elevate Mech. & Elec.

  - Standby Generator
  - Fuel Tank anchorage
  - Operation plan

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New England Youth Theater

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New England Youth Theater

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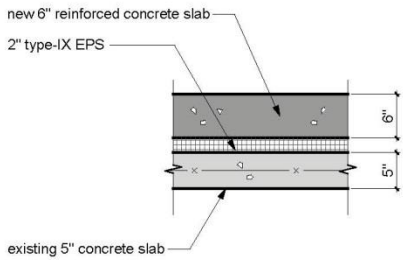
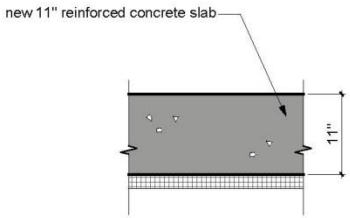
New England Youth Theater



New Concrete Slab Over Existing Slab



New 11" Thick Concrete Slab

No Floor Drains

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Substantial Damage/Improvement

Melrose Terrace, West Brattleboro, during Hurricane Irene

- Market Value
- Cost of Work <50%

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Market Value (Building Only)

Melrose Terrace, West Brattleboro, during Hurricane Irene

- Assessed Value
- Appraised Value
- Actual Cost Value

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Cost of Work (3 Years)

- Excludes clean-up
- Excludes site work
- Excludes some code-required work
- Market value for donations/premiums

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Historic Building Flood Proofing

National Flood Insurance Program (NFIP)

Floodplain Management Bulletin

Historic Structures

FEMA P-467-2

May 2008

- Exception for Historic Structures
- Subsidized Flood Insurance through NFIP
- (1) Exclusion from substantial improvement
- (2) Variance

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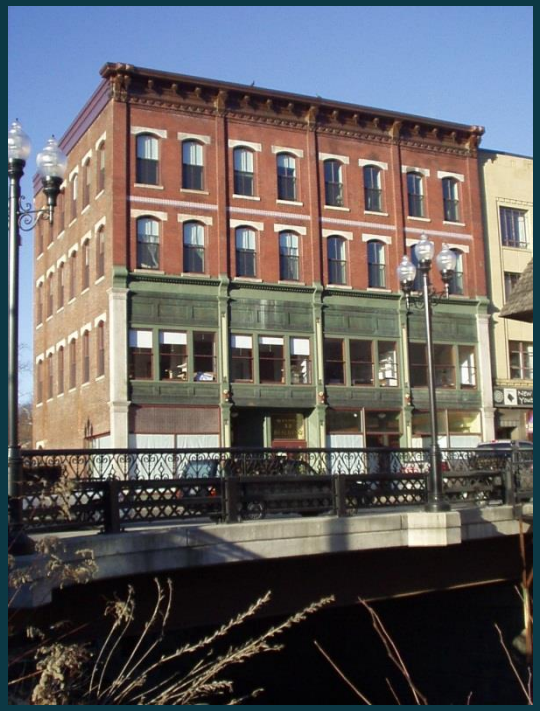
Historic Building Flood Proofing



The Wilder Building after rebuilding

- FEMA Variance
  "…the proposed repair will not preclude the structure from continued designation and is the minimum necessary…"

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Smart Design for Livable Communities

References

- FEMA Technical Bulletin 7-93, “Flood Proofing Non-Residential Buildings.”
- ASCE 24-05, “Flood-Resistant Design & Construction.”
- FEMA P-75B, “Substantial Improvement/Substantial Damage Desk Reference.”
- FEMA P-467 Historic Structures

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SMART DESIGN FOR LIVABLE COMMUNITIES

FLOOD RESISTANT DESIGN CASE STUDIES

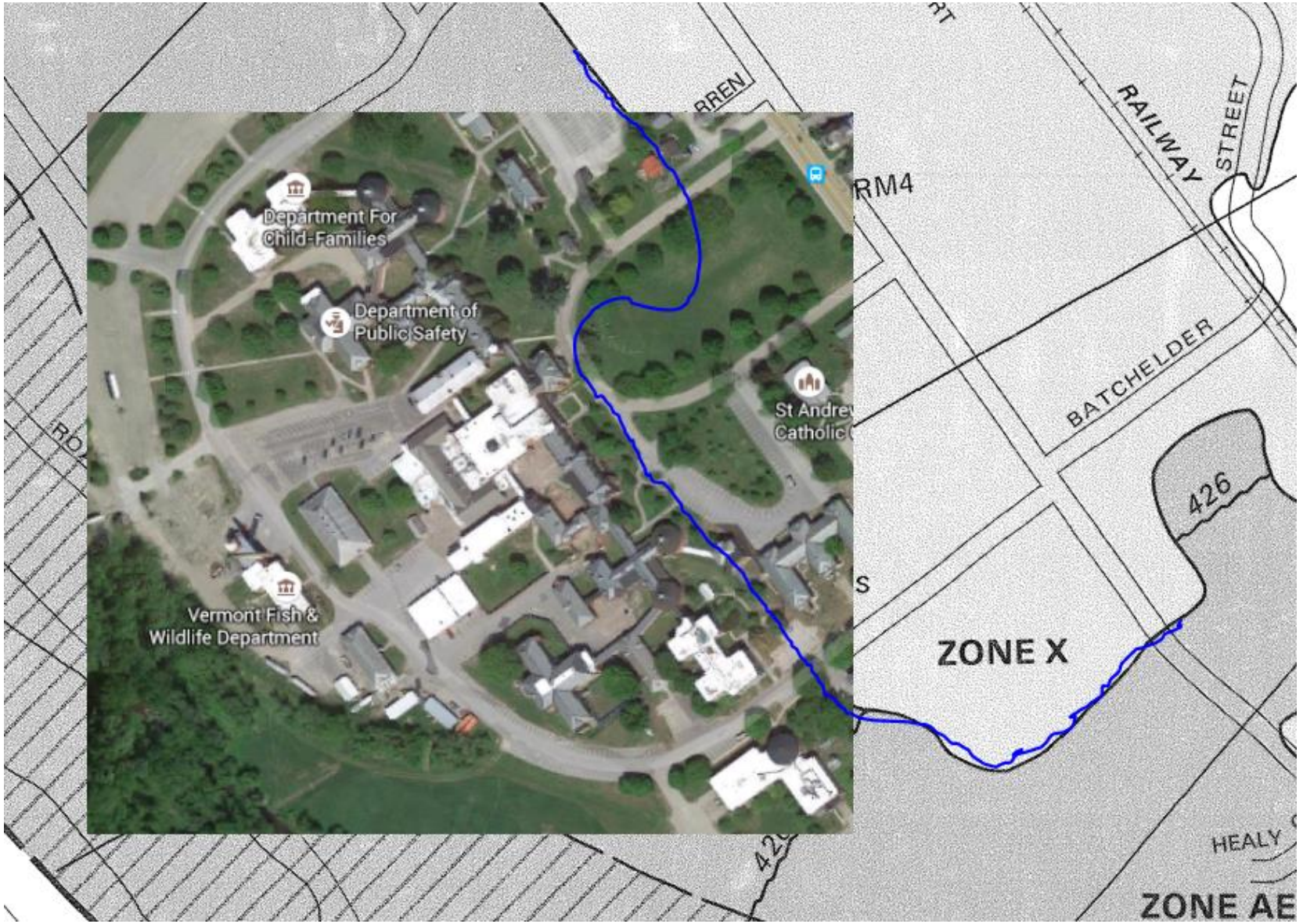
ENGINEERING VENTURES PC

- Bob Neeld, Professional Engineer
- President Engineering Ventures, PC
  Burlington, VT and Lebanon, NH

- Waterbury State Office Complex 2015
- Burnham Hall, Lincoln, VT 2007

FLOOD RESISTANT DESIGN

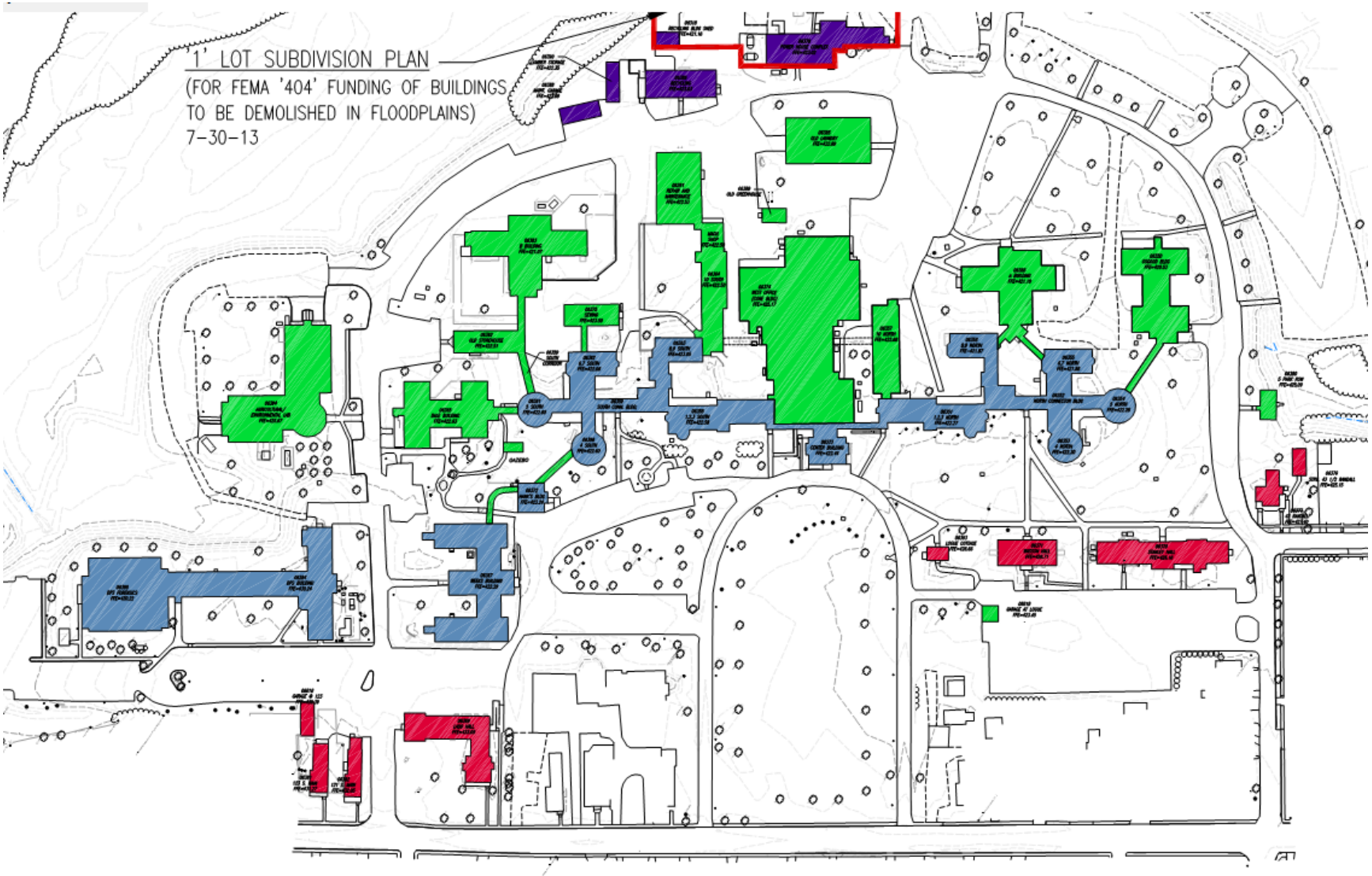
- Waterbury State Office Complex
- Severely Damaged by Irene Flooding


Department For Child-Families
Department of Public Safety
Vermont Fish & Wildlife Department
St Andrew Catholic
RAILWAY
STREET
BATCHELDER
426
ZONE X
HEALY
ZONE AE

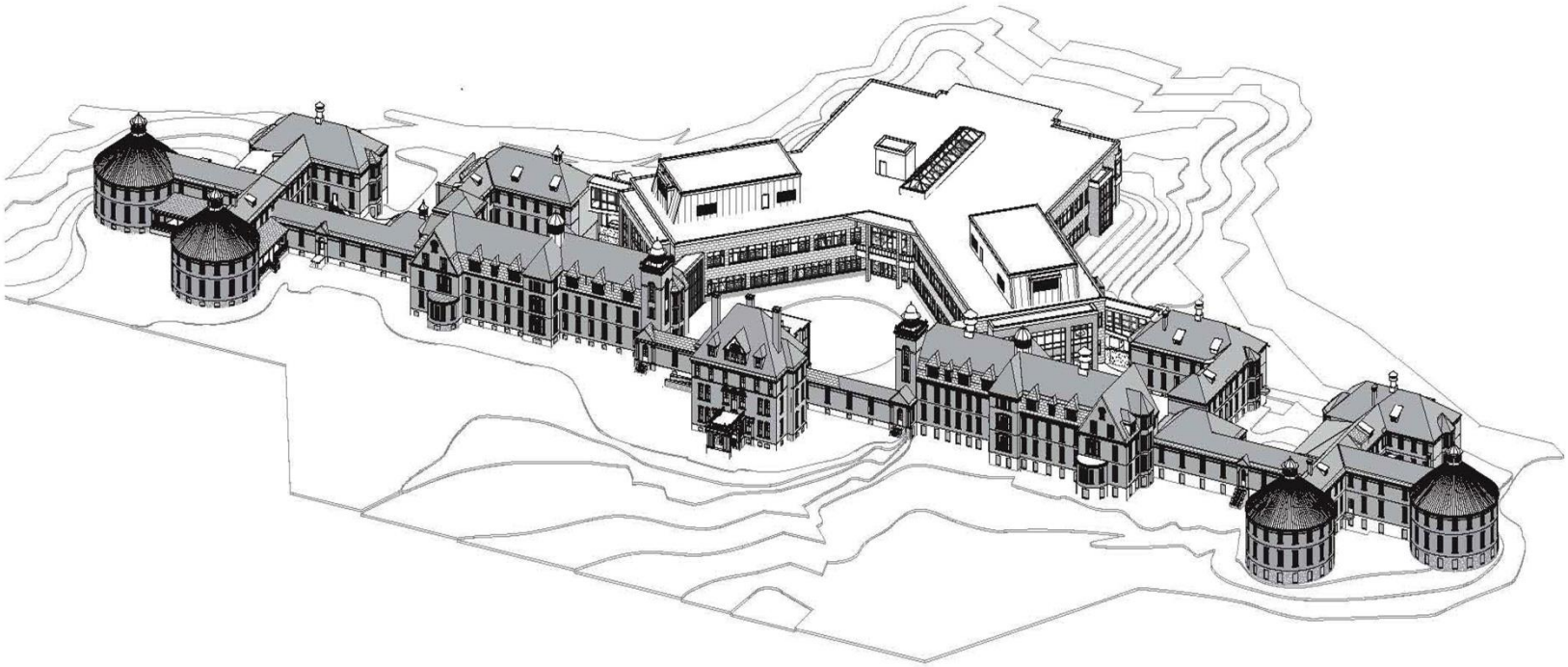
FLOOD RESISTANT DESIGN STRATEGIES WATERBURY OFFICE COMPLEX

- Demolition of severely damaged structures
- Dry flood proofing of historic core
- New structures elevated above flood zone
- Cut and fill configured for no-rise in flood elev
- Site Resiliancy- Riparian plantings and grass swales

Existing Conditions



PROPOSED CONDITIONS



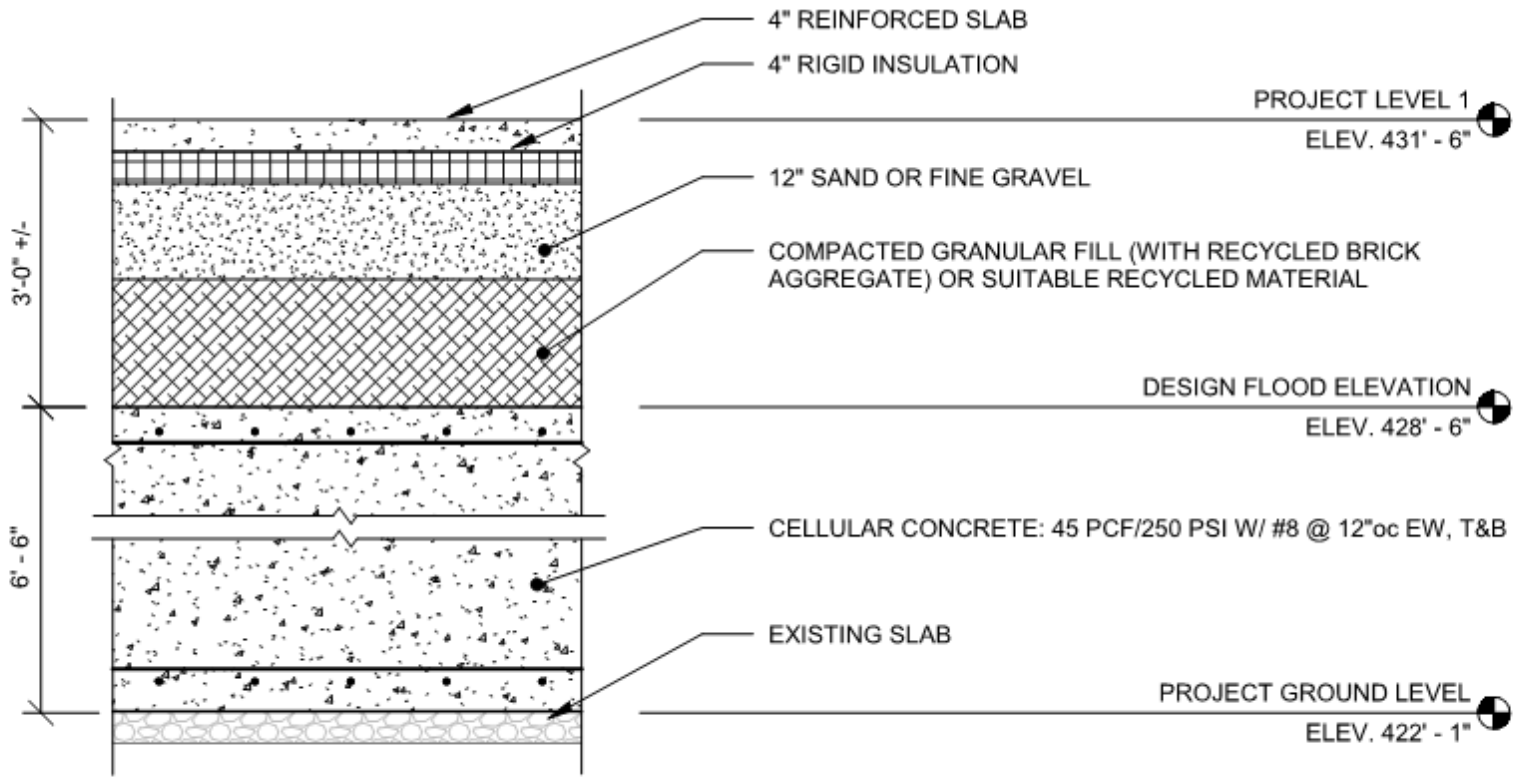
A004 | AXONOMETRIC VIEW LOOKING SOUTHWEST

April 9, 2013

freeman | french | freeman

Goody Clancy
ARCHITECTURE
PLANNING
PRESERVATION

Fill at Historic Core



1 WB - 1
1/2" = 1'-0"

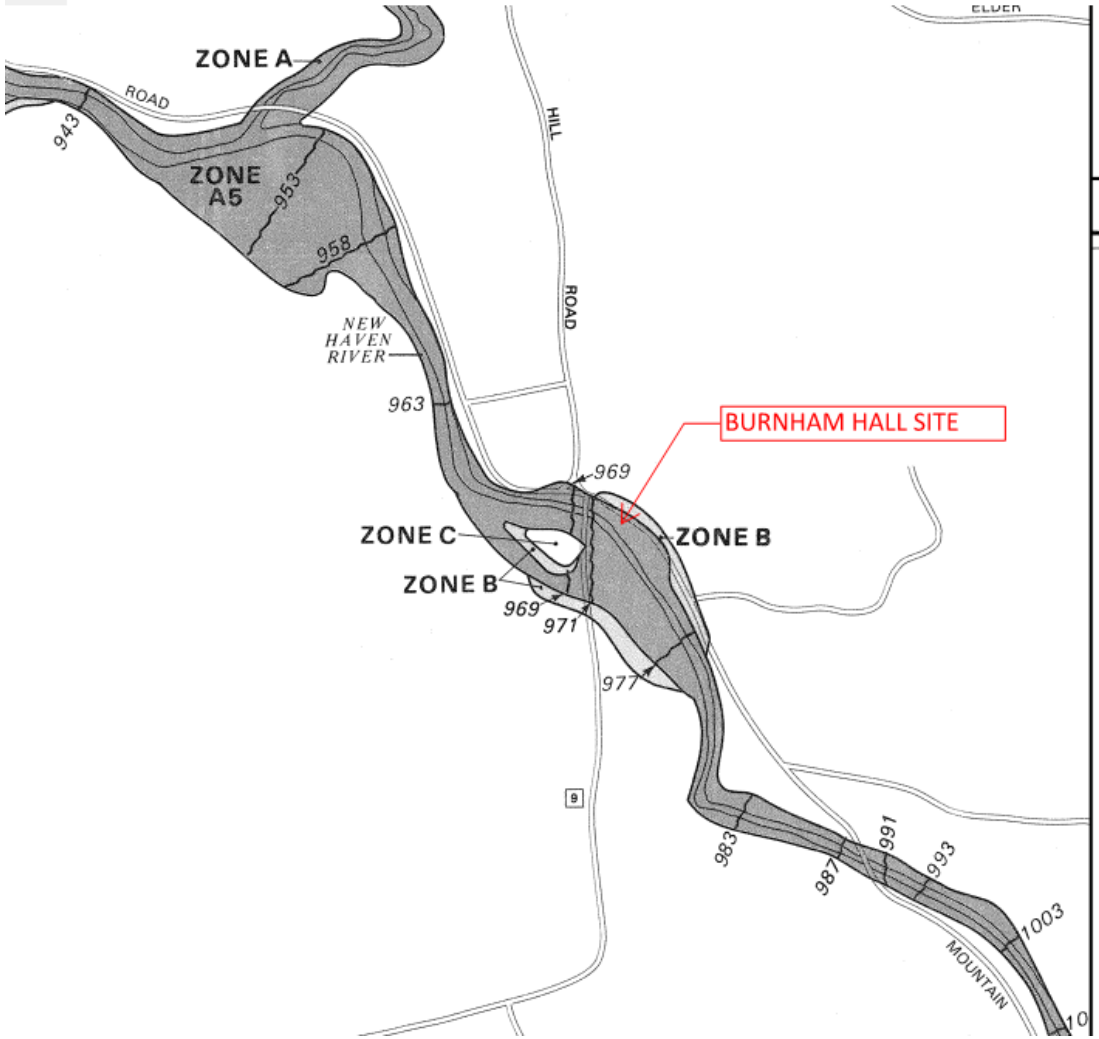
Flood Resistant Design

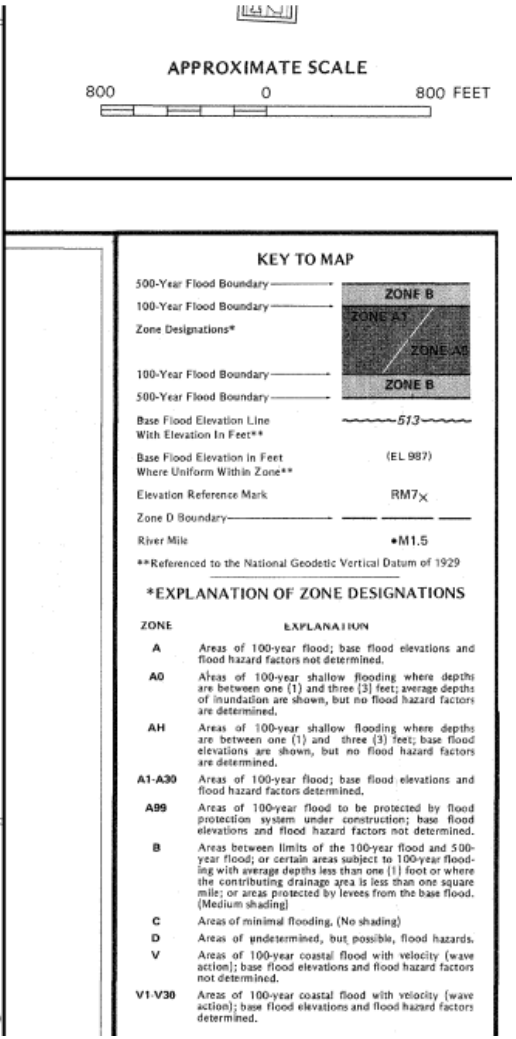
- Burnham Hall, Lincoln Vermont
- 2007 Design and construction project


Burnham Hall, circa 1920
Lincoln, Vermont
FEMA

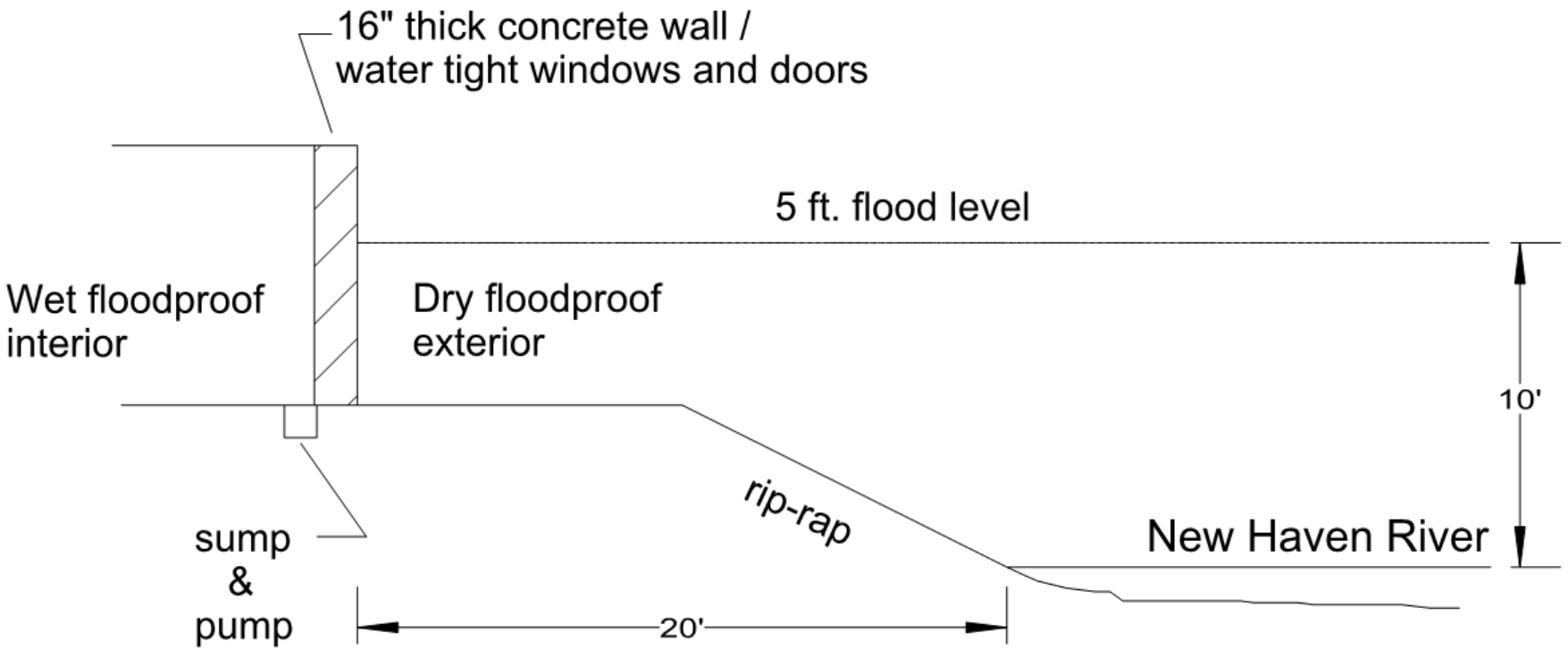

Gove Hill Rd
East River Rd
Clark Rd
New Haven River
East River Rd

Firmette Flood Map



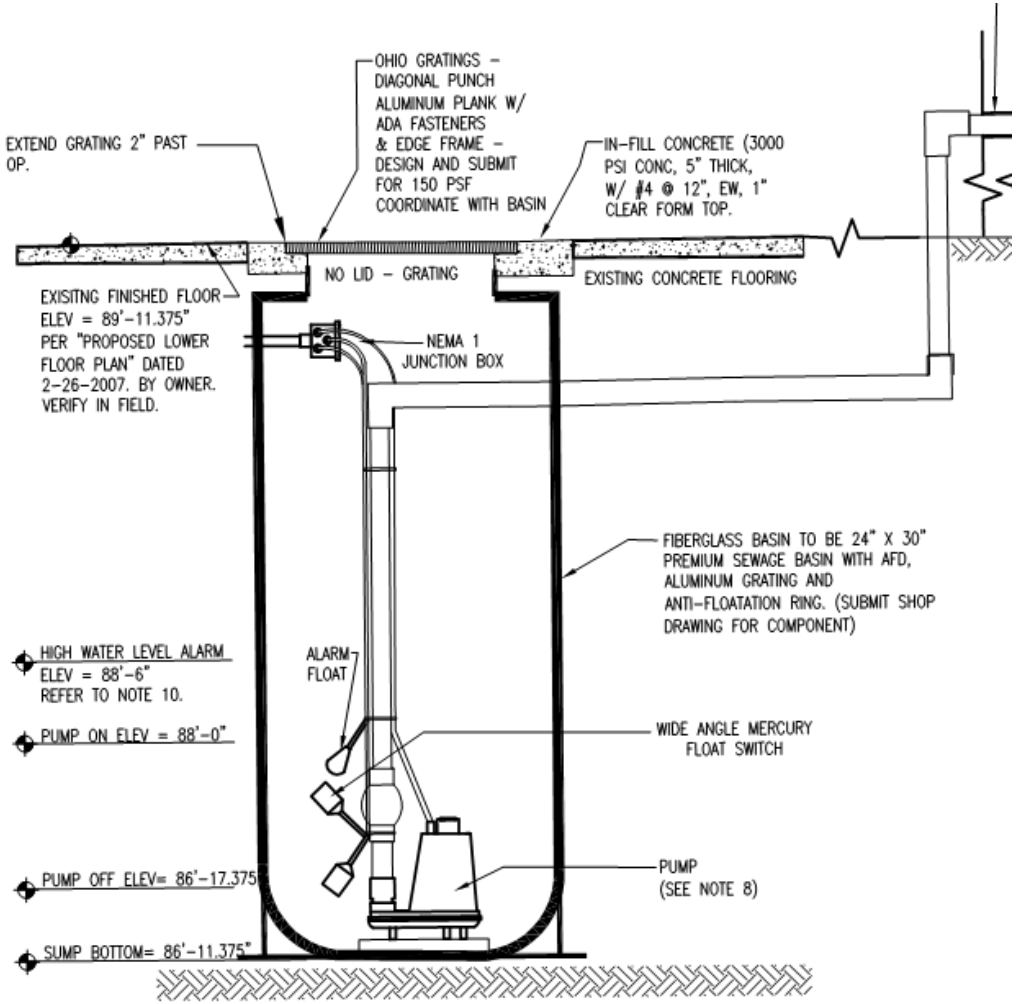


Schematic Section



Hybrid dry/wet floodproofing (wet floodproofing with mitigation)

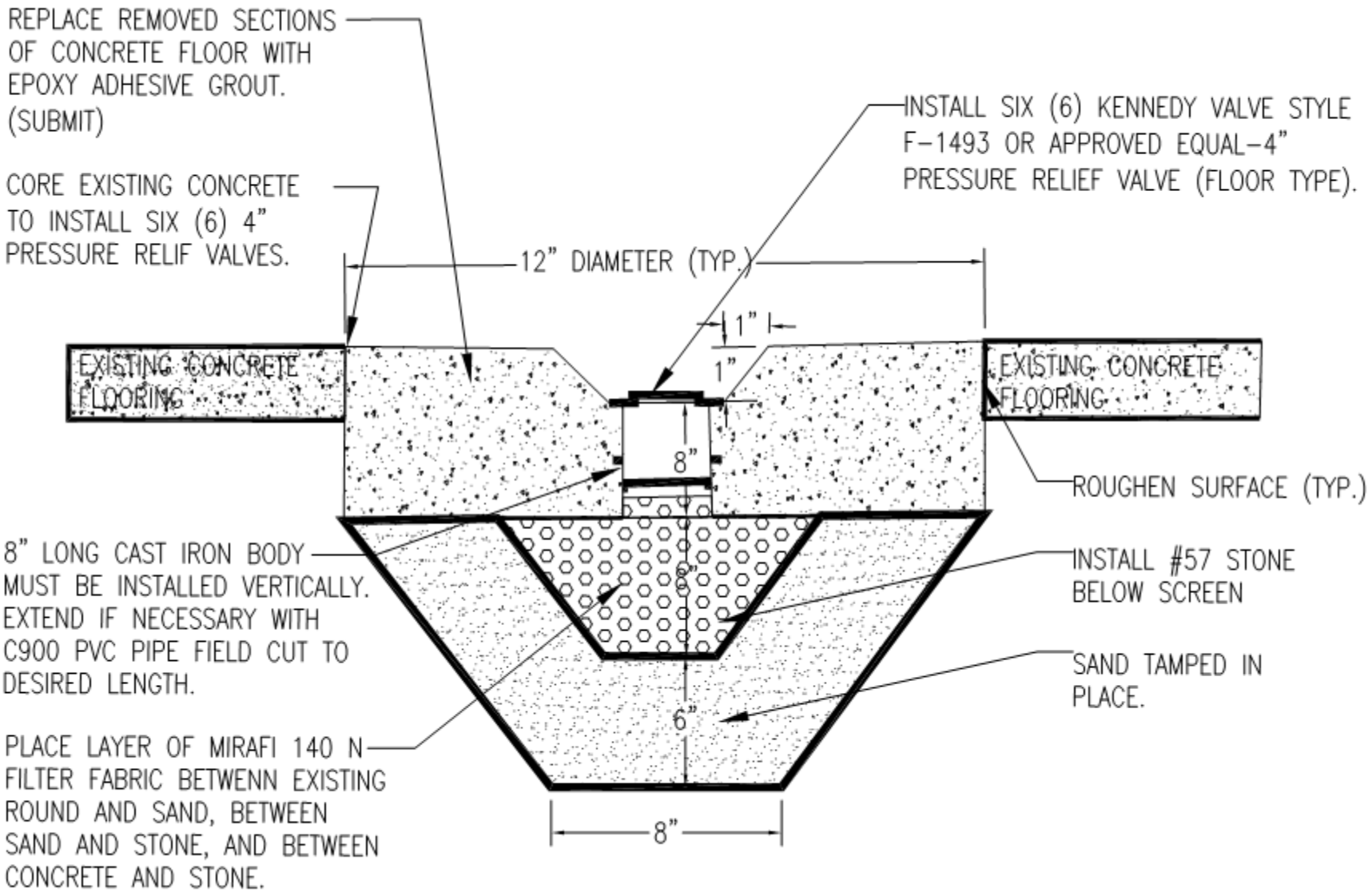
- Slide gates for windows and doors
- 16” concrete walls- adequate for hydrostatic pressure.
- Evaluate water movement through soil
- Pressure relief valves in floor slab
- Knife Valve to close off sewer service
- Sump pump to minimize infiltration depth



SECTION VIEW

SUMP DETAIL

NOT TO SCALE


REPLACE REMOVED SECTIONS OF CONCRETE FLOOR WITH EPOXY ADHESIVE GROUT. (SUBMIT)
CORE EXISTING CONCRETE TO INSTALL SIX (6) 4" PRESSURE RELIF VALVES.
INSTALL SIX (6) KENNEDY VALVE STYLE F-1493 OR APPROVED EQUAL-4" PRESSURE RELIEF VALVE (FLOOR TYPE).
12" DIAMETER (TYP.)
1"
1"
EXISTING CONCRETE FLOORING
EXISTING CONCRETE FLOORING
8"
ROUGHEN SURFACE (TYP.)
8" LONG CAST IRON BODY MUST BE INSTALLED VERTICALLY. EXTEND IF NECESSARY WITH C900 PVC PIPE FIELD CUT TO DESIRED LENGTH.
8"
INSTALL #57 STONE BELOW SCREEN
SAND TAMPED IN PLACE.
6"
PLACE LAYER OF MIRAFI 140 N FILTER FABRIC BETWENN EXISTING ROUND AND SAND, BETWEEN SAND AND STONE, AND BETWEEN CONCRETE AND STONE.
8"


A2650RSN
4
2004

FLOOD RESISTANT DESIGN CASE STUDIES

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